IP Addresses

❯ **An IP address uniquely identifies an internet connected device on a network.**
- Devices using IP addresses use the internet protocol to communicate using TCP/IP & UDP/IP.
- The Internet Assigned Numbers Authority (IANA) assigns IP addresses to regional internet registries (RIRs). The RIRs assign them to Internet Service Providers. Internet Service Providers then assign IP addresses to their customers.

❯ **IPv4 (IP Version 4) Address Format**
- IPv4 addresses are 32 bits long (2^{32}) and made up of 4 bytes separated by dots.
- The IPv4 address format has around 4.3 Billion unique addresses.
- Example Address: 216.58.216.164

	Most significant byte			Least significant byte
DECIMAL:	192 .	168 .	10 .	164
BINARY:	1100 0000	1010 1000	0000 1010	0011 0100
HEX:	C0	A8	A	34

❯ **Private IP Address Ranges**
- **Class A:** 10.0.0.0 − 10.255.255.255 (16,777,216 IP addresses)
- **Class B:** 172.16.0.0 − 172.16.255.255 (1,048,576 IP addresses)
- **Class C:** 192.168.0.0 − 192.168.255.255 (65,536 IP addresses)

- Private IP addresses can be assigned freely on a local area network. Since they are not unique, they are not routed on the internet.
- Network address translation (NAT) can be used on this address space to remap one IP address into mutiple addreesses, saving valuble IPv4 addreses space.

❯ **IPv6 (IP Version 6) Address Format**
- IPv4 addresses are running out, IPv6 was created to solve this issue.
- An IPv6 address is 128 bits long (2^{128}). That's 340 undecillion or 340 billion billion billion billion possible unique addresses.
- IPv6 is expressed as 8, 16 bit numbers in hexadecimal notation.
- Example Address: 2601:7c1:100:ef69:b5ed:ed57:dbc0:2c1e

	Most significant 16 bit number							Least significant 16 bit number
HEX:	2601	07c1	0100	ef69	b5ed	ed57	dbc0	2c1e
DECIMAL:	9729	1985	256	61289	46573	60759	56256	11294
BINARY:	10011000000001	11111000001	100000000	1110111101101001	1011010111101101	1110110101010111	1101101111000000	10110000011110